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The only plus value comes between the first two periods and the lowest values are between the 8–10 and the 10–12½ day periods.

An examination of these values and a comparison with the facts of histogenesis shows that acceleration of rate is a plus quantity only during the period before active differentiation of the cells has begun. The retarding effect is evident with the beginning of apparent tissue differentiation and by the ninth to eleventh days the negative acceleration is at its height.

The percentage increments for the six periods represented are respectively 106, 28, 12, 5, 0 and 0 (fig. 5). There is a very rapid decrease at first and then a slower and slower one as zero is approached. The data agree with those of ordinary growth.

First regenerations of frog tadpoles gave results which were essentially similar to those for second regenerations.

The data will appear in full in the *University of Illinois Biological Monographs.*

PRELIMINARY NOTE ON THE DISTRIBUTION OF STARS WITH RESPECT TO THE GALACTIC PLANE

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A significant feature of the distribution of stars over the face of the sky is their concentration toward the plane of the Galaxy. Approaching the Milky Way from either side, we find that objects of all degrees of brightness become more and more numerous; with decreasing galactic latitude, the star-density regularly increases and attains a maximum in the star clouds of the Milky Way itself, a fact long known and, as early as 1750, the basis of cosmological speculation by Thomas Wright of Durham.[1] The phenomenon was studied by both the Herschels, and more recently Seeliger, Celoria, Pickering, Kapteyn,[2] and Chapman and Melotte,[3] among others, have given values of the stellar density; and yet, from a numerical standpoint, the matter remains even now more or less an open question.

Our knowledge of stellar distribution must include the total number of stars per unit area at each galactic latitude, and, as well, of the number for each interval of magnitude from the brightest to the faintest; moreover, the magnitudes themselves must be homogeneous and in accordance with a uniform scale. The Herschel counts, giving only totals to a certain limit near the 14th magnitude, do not satisfy these conditions. Seeliger's results, based mainly on the great *Bonner Durchmusterung* catalogues of nearly half a million stars, though affording results for graduated intervals of brightness, do not go below the 10th magnitude. Celoria's counts include fainter objects, but, like those of the Herschels, are only totals for a certain range of magnitude.

To revise these results and extend them to the stars within reach of modern telescopes, Kapteyn, in 1908, discussed all the reliable data then available. His magnitudes for the fainter stars are on the visual scale of Parkhurst,[4] and to the 15th magnitude depend on photometric standards. Beyond this his tables of distribution are extrapolated, but the changes with increasing magnitude are so regular that his values should be reliable to a somewhat fainter limit, provided the photometric standards are not in error.

The latest study of stellar distribution, depending largely on the excellent photographs secured on the initiative of Franklin-Adams, is also of special interest. Transferring the scale of the Harvard Polar Sequence to thirty of the Franklin-Adams regions by means of intercomparison photographs, Chapman and Melotte derived values of the star-density for magnitudes 12 to 17. Other plates gave results for the brighter stars, which also are referred to the Harvard photographic scale.

A comparison with Kapteyn's results reveals two important facts:

(*a*) Kapteyn's total of stars in the whole sky to specified limits of magnitude is systematically the larger. Approximately 50% greater from the 4th to the 10th magnitudes inclusive, it increases rapidly for fainter limits, and at the 17th magnitude is 7 times that of Chapman and Melotte.

(*b*) With increasing magnitude, the galactic condensation (ratio of star-density at galactic latitude 5° to that at 80°) increases:

Limiting Magnitude	5	7	9	11	13	15	17
Kapteyn	2.13	2.25	2.82	4.3	7.9	17.5	44.8
Chapman and Melotte	2.06	2.26	2.69	3.2	3.7	4.1	4.3

To the 9th magnitude there is agreement, but beyond, Kapteyn's values are greatly in excess.

The difference noted in (*a*) is, in part, to be expected, for in one case the magnitudes are visual, in the other, photographic. The number of stars to a specified visual limit is necessarily greater than that to the same limit on the photographic scale, the excess depending on their color. To the 10th magnitude the two results thus agree well enough;

for but lower limits the differences suggest a divergence of the scales, or, perhaps, an increase in the average color of the stars. The faint stars are really redder, at least in certain regions; but, by itself, increased color is inadequate as an explanation. On the other hand, there is evidence that below the 10th magnitude Parkhurst's photometric standards, upon which Kapteyn's scale is based, are increasingly too bright. Kapteyn's tabulated densities therefore properly apply to magnitudes which are fainter, by gradually increasing amounts, than those used as arguments for his tables. The probable amount of the scale divergence is sufficient to account for the relatively rapid increase of Kapteyn's totals, which, in any case, must be associated mainly with the characteristics of the photometric standards; for the supposition that Parkhurst's scale is normal would imply that the fainter stars are very red, and Kapteyn's large totals would then be referable to the high color thus presupposed.

The differences in galactic condensation shown under (*b*) are more difficult to explain. Scale differences between galactic and non-galactic regions, and systematic errors in the counts depending on galactic latitude are factors which obviously might enter. Some information is given by the photographic magnitudes of stars in the Selected Areas now being determined at Mount Wilson.[5] Ultimately these will yield results for graduated intervals of magnitude, but at present only total densities to the limiting magnitude of the plates are available.

ZONE	TOTAL NUMBER OF STARS	LOG MEAN NUMBER STARS	MEAN GAL. LAT.	GAL. LAT.	LOG. N_m MW	MW *minus* C and M	GRONINGEN MAGNITUDE	LOG. N_m KAPTEYN	MW *minus* KAPTEYN
I	13,702	3.10	2°	5°	4.12	+0.74	16.2	4.17	−0.05
II	12,322	3.05	11	15	3.86	+0.57	16.3	3.86	0.00
III	6,010	2.74	19	25	3.53	+0.37	16.2	3.58	−0.05
IV	2,751	2.40	29	35	3.26	+0.29	16.1	3.33	−0.07
V	1,743	2.20	39	45	3.10	+0.28	16.2	3.14	−0.04
VI	1,350	2.09	48	55	2.98	+0.13	16.3^5	2.97	+0.01
VII	987	1.95	59	65	2.89	+0.08	16.6	2.82	+0.07
VIII	767	1.84	73	80	2.79	+0.04	16.9	2.66^5	$+0.12^5$

The counts, now complete for 88 areas, include nearly 40,000 stars. These have been divided into eight groups according to galactic latitude, as shown in the first four columns of the table. Variations in the limiting magnitude from plate to plate cause some uncertainty; but, since each group includes eleven areas and the number in each area has been derived from the better of two photographs, the means per field cannot be seriously affected. The fields are small (one ninth of a square degree), but local variations of density have been well eliminated and the mean number of stars increases uniformly with decreasing galactic latitude. With the exception of Zones I and II which include the irregular cloud-forms of the Milky-Way, the deviations from the smooth curve of the plotted data are only 2 or 3%.

For comparison with other results the logarithms of the numbers of stars have been reduced to the latitudes in the fifth column and referred to the square degree as unit. The resulting logarithms of the star-density (number of stars per square degree brighter than the limiting magnitude) are in the sixth column.

The zero point corrections of the Mount Wilson results have not yet been found, but since Pickering has determined the visual intensity of the central star of each Selected Area, the approximate limiting magnitude is known. His data fix the zero point and indicate a mean apparent limit of 17.1, but, to obtain the real limit on the photographic scale, this must be increased by the average color index of the central stars. Adopting 0.6 as the average color, we have 17.7; the counts are not complete, however, for the last few tenths of a magnitude, and we accept provisionally 17.5 photographic as the limit of the Mount Wilson densities.

Since the results of Chapman and Melotte do not extend below the 17th magnitude, their data used for the comparison in the seventh column of the table are for this limit. The Mount Wilson densities, referring to 17.5, should be the larger by approximately 50%. At 80° the excess is only 10%, but increases rapidly toward the lower latitudes, and at 5° the Mount Wilson value is 5.5 times that of Chapman and Melotte. This divergence is remarkable and, in its implications, serious.

In comparing Mount Wilson and Groningen results, Professor Kapteyn has called my attention to the importance of using the same limiting magnitude for both series of counts, in order to avoid the disturbing effect of the rapid change in galactic condensation with magnitude previously alluded to. The magnitude on the Groningen scale corresponding to the Mount Wilson limit can be interpolated from Kapteyn's tables with the Mount Wilson values of log N_m as argument. The results for each zone of latitude are in the eighth column of the above table. The agreement, excepting for the last two values is close and indicates a very satisfactory homogeneity in the counts. The mean of 16.3 is accordingly the Groningen visual magnitude corresponding to the Mount Wilson limit, provisionally placed at 17.5 photographic. Of the difference between these quantities, perhaps half a magnitude is to be attributed to the color of the stars; the remaining 0.7 or 0.8 mag. is the indicated error of the Groningen scale, and agrees with what was to have been anticipated from evidence relating to the photometric standards of Parkhurst.

Interpolating now from Kapteyn's tables for magnitude 16.3, we obtain the densities in the ninth column, and, finally the differences in the last column. These are in nowise affected by the outstanding errors in the scales, and, though systematic, are very small. The values of the galactic condensation for the limiting magnitude here considered are, respectively, Kapteyn, 32; Mount Wilson, 21.4.

The relation of the Groningen and Mount Wilson scales has been derived on the assumption that equal densities correspond to the same limit of brightness. Were the scales of the same kind—both photographic or both visual—the difference in the limits for equal densities would be their relative error; as it is, the numerical difference in the limits must be apportioned between scale error and the influence of the color of the stars. With the distribution suggested above, the influence of relative scale error would cause Kapteyn's total at the 16th or 17th magnitude for all the stars to exceed by two or three times that indicated by the Mount Wilson counts. His values for the totals are probably to be decreased, though not by the amount suggested by the figures of Chapman and Melotte.

In estimating the significance of the small divergence shown by the last column of the table, which tests the relative homogeneity of the Groningen and Mount Wilson counts, the following should be noted: Kapteyn's values are extrapolated a magnitude or more beyond the limit for which he had photometric standards; and, for many regions, he experienced much difficulty in determining the necessary magnitudes. Further, the Mount Wilson counts are determined by the limiting magnitudes of the photographs, and although well distributed in latitude, variations from zone to zone may affect the totals. The agreement in distribution—even in the values of the galactic condensation, which are unduly influenced by the large deviation near the pole—is therefore very good.

A comparison of Mount Wilson with Chapman and Melotte for corresponding magnitudes might also have been made, but the conclusions which would have followed were obvious, for the large divergence shown in the seventh column of the table is little affected by differences in the limiting brightness. This divergence indicates that, as compared with both Kapteyn and Mount Wilson, their results are not homogeneous; and noting, further, that the numerous and careful guages of the Herschels which extend to the 14th magnitude give a galactic condensation agreeing closely with Kapteyn (Herschel 12.9, Kapteyn 11, Chapman and Melotte 3.9), one gains the impression that, through some unknown cause, their counts in the richer fields fail to include many of the fainter stars.

[1] Wright, T., *Theory of the Universe*, London, 1750.

[2] Kapteyn, J. C., *Pub. Astr. Lab. at Groningen, Groningen*, No. 18, 1908, (1–54). This memoir includes bibliographical references to earlier investigations.

[3] Chapman, B. A. and Melotte, P. J., *Mem. R. Astr. Soc., London*, **60**, 1914 (145–173).

[4] Parkhurst, J. A., Researches in Stellar Photometry, *Washington, Carnegie Inst., Pub.*, No. 33, 1906, (1–192). Similar results for the fields of several variable stars have appeared from time to time in the *Astrophysical Journal*.

[5] Seares, F. H., These PROCEEDINGS, **3**, 1917, (188–191).

A CORRECTION

Professor Alexander McAdie has kindly drawn my attention to an error in dates occurring in my paper, Inferences Concerning Auroras, published in the Proceedings for January, 1917, pages 1–7. In reference to the "Aurora of April, 1883", he has convinced me from his data that the particular event occurred on November 17, 1882. My mistake was due to faulty references, and in no way affects the general argument.

ELIHU THOMSON.